

Claims:

1. A bushing for fiberizing a molten material comprising at least two opposed sidewalls and at least two opposed end walls, a tip plate having a plurality of hollow tips extending from a lower surface, the tip plate being attached to the sidewalls and end walls, the bushing having a boxlike shape having at least four interior corners, an interior support structure welded to a top surface of the tip plate for supporting the tip plate, and a screen in the bushing resting on or mounted very near the top of the interior support structure, the interior support structure comprising a plurality of intersecting or crossing internal supports with angles between the intersecting supports at each intersection, the internal support structure, in cooperation with the at least one sidewall and the at least one end wall, forming at least 16 cells located between the bottom of the screen and the top of the tip plate, the screen having a plurality of screen areas containing holes through the screen with a screen area above each of the cells, the hole area per unit screen area being different in some screen areas than in other screen areas to achieve more uniform tip plate temperature profile.
2. The bushing of claim 1 wherein the interior support structure is made of a precious metal or a precious metal alloy.
3. The bushing of claim 1 wherein the interior support structure contains diamond shaped cells and is also attached to the sidewalls.
4. The bushing of claim 2 wherein the interior support structure contains diamond shaped cells and is also attached to the sidewalls.
5. The bushing of claim 1 wherein supports that are part of the interior support structure enter the interior corners of the bushing.
6. The bushing of claim 2 wherein supports that are part of the interior support structure enter the interior corners of the bushing.

7. The bushing of claim 3 wherein supports that are part of the interior support structure enter the interior corners of the bushing.
8. The bushing of claim 1 wherein the bushing contains at least 32 cells between the screen and the tip plate.
9. The bushing of claim 2 wherein the bushing contains at least 32 cells between the screen and the tip plate.
10. The bushing of claim 3 wherein the bushing contains at least 32 cells between the screen and the tip plate.
11. The bushing of claim 1 wherein a screen area closest to each corner of the bushing has a hole area per unit screen area that is substantially greater than that of the screen areas that are closest to a lengthwise centerline of the screen.
12. The bushing of claim 2 wherein a screen area closest to each corner of the bushing has a hole area per unit screen area that is substantially greater than that of the screen areas that are closest to a lengthwise centerline of the screen.
13. The bushing of claim 3 wherein a screen area closest to each corner of the bushing has a hole area per unit screen area that is substantially greater than that of the screen area that is closest to a lengthwise centerline of the screen.
14. The bushing of claim 4 wherein a screen area closest to each corner of the bushing has a hole area per unit screen area that is substantially greater than that of the screen area that is closest to a lengthwise centerline of the screen.
15. The bushing of claim 5 wherein a screen area closest to each corner of the bushing has a hole area per unit screen area that is substantially greater than that of the screen area that is closest to a lengthwise centerline of the screen.

16. The bushing of claim 6 wherein a screen area closest to each corner of the bushing has a hole area per unit screen area that is substantially greater than that of the screen area that is closest to a lengthwise centerline of the screen.
17. The bushing of claim 7 wherein a screen area closest to each corner of the bushing has a hole area per unit screen area that is substantially greater than that of the screen area that is closest to a lengthwise centerline of the screen.
18. The bushing of claim 8 wherein a screen area closest to each corner of the bushing has a hole area per unit screen area that is substantially greater than that of the screen area that is closest to a lengthwise centerline of the screen.
19. The bushing of claim 9 wherein a screen area closest to each corner of the bushing has a hole area per unit screen area that is substantially greater than that of the screen area that is closest to a lengthwise centerline of the screen.
20. The bushing of claim 10 wherein a screen area closest to each corner of the bushing has a hole area per unit screen area that is substantially greater than that of the screen area that is closest to a lengthwise centerline of the screen.
21. The bushing of claim 1 wherein screen areas nearest an end wall of the bushing have a substantially higher hole area per unit screen area than screen areas closest to a lengthwise centerline of the screen.
22. The bushing of claim 2 wherein screen areas nearest an end wall of the bushing have a substantially higher hole area per unit screen area than screen areas closest to a lengthwise centerline of the screen.
23. The bushing of claim 3 wherein screen areas nearest an end wall of the bushing have a substantially higher hole area per unit screen area than screen areas closest to a lengthwise centerline of the screen.

24. The bushing of claim 4 wherein screen areas nearest an end wall of the bushing have a substantially higher hole area per unit screen area than screen areas closest to a lengthwise centerline of the screen.
25. The bushing of claim 5 wherein screen areas nearest an end wall of the bushing have a substantially higher hole area per unit screen area than screen areas closest to a lengthwise centerline of the screen.
26. The bushing of claim 6 wherein screen areas nearest an end wall of the bushing have a substantially higher hole area per unit screen area than screen areas closest to a lengthwise centerline of the screen.
27. The bushing of claim 7 wherein screen areas nearest an end wall of the bushing have a substantially higher hole area per unit screen area than screen areas closest to a lengthwise centerline of the screen.
28. The bushing of claim 8 wherein screen areas nearest an end wall of the bushing have a substantially higher hole area per unit screen area than screen areas closest to a lengthwise centerline of the screen.
29. The bushing of claim 9 wherein screen areas nearest an end wall of the bushing have a substantially higher hole area per unit screen area than screen areas closest to a lengthwise center line of the screen.
30. The bushing of claim 10 wherein screen areas nearest an end wall of the bushing have a substantially higher hole area per unit screen area than screen areas closest to a lengthwise centerline of the screen.
31. A bushing for fiberizing a molten material comprising at least two opposed sidewalls and at least two opposed end walls, a tip plate having a plurality of hollow tips extending from a lower surface, the tip plate being attached to the sidewalls and end walls, the bushing having a boxlike shape having at least four interior corners, an interior support structure welded to a top surface of the tip plate for supporting the tip plate, and a screen

in the bushing resting on or mounted very near the top of the interior support structure, the interior support structure comprising a plurality of intersecting or crossing internal supports with angles between the intersecting supports at each intersection, the internal support structure, in cooperation with the at least one sidewall and the at least one end wall, forming at least 32 cells located between the bottom of the screen and the top of the tip plate, the screen having a plurality of screen areas containing holes through the screen with a screen area above each of the cells, the hole area per unit screen area being different in some screen areas than in other screen areas to achieve more uniform tip plate temperature profile.

32. The bushing of claim 31 wherein the interior support structure is made of a precious metal or a precious metal alloy.

33. The bushing of claim 31 wherein the interior support structure contains diamond shaped cells and is also attached to the sidewalls.

34. The bushing of claim 32 wherein the interior support structure contains diamond shaped cells and is also attached to the sidewalls.

35. The bushing of claim 31 wherein supports that are part of the interior support structure enter the interior corners of the bushing.

36. The bushing of claim 32 wherein supports that are part of the interior support structure enter the interior corners of the bushing.

37. The bushing of claim 33 wherein supports that are part of the interior support structure enter the interior corners of the bushing.

38. The bushing of claim 31 wherein the bushing contains at least 34 cells between the screen and the tip plate.

39. The bushing of claim 32 wherein the bushing contains at least 34 cells between the screen and the tip plate.

40. The bushing of claim 33 wherein the bushing contains at least 34 cells between the screen and the tip plate.
41. The bushing of claim 31 wherein a screen area closest to each corner of the bushing has a hole area per unit screen area that is substantially greater than that of the screen areas that are closest to a lengthwise centerline of the screen.
42. The bushing of claim 32 wherein a screen area closest to each corner of the bushing has a hole area per unit screen area that is substantially greater than that of the screen areas that are closest to a lengthwise centerline of the screen.
43. The bushing of claim 33 wherein a screen area closest to each corner of the bushing has a hole area per unit screen area that is substantially greater than that of the screen area that is closest to a lengthwise centerline of the screen.
44. The bushing of claim 34 wherein a screen area closest to each corner of the bushing has a hole area per unit screen area that is substantially greater than that of the screen area that is closest to a lengthwise centerline of the screen.
45. The bushing of claim 35 wherein a screen area closest to each corner of the bushing has a hole area per unit screen area that is substantially greater than that of the screen area that is closest to a lengthwise centerline of the screen.
46. The bushing of claim 36 wherein a screen area closest to each corner of the bushing has a hole area per unit screen area that is substantially greater than that of the screen area that is closest to a lengthwise centerline of the screen.
47. The bushing of claim 37 wherein a screen area closest to each corner of the bushing has a hole area per unit screen area that is substantially greater than that of the screen area that is closest to a lengthwise centerline of the screen.

48. The bushing of claim 38 wherein a screen area closest to each corner of the bushing has a hole area per unit screen area that is substantially greater than that of the screen area that is closest to a lengthwise centerline of the screen.

49. The bushing of claim 39 wherein a screen area closest to each corner of the bushing has a hole area per unit screen area that is substantially greater than that of the screen area that is closest to a lengthwise centerline of the screen.

50. The bushing of claim 40 wherein a screen area closest to each corner of the bushing has a hole area per unit screen area that is substantially greater than that of the screen area that is closest to a lengthwise centerline of the screen.

51. The bushing of claim 31 wherein screen areas nearest an end wall of the bushing have a substantially higher hole area per unit screen area than screen areas closest to a lengthwise centerline of the screen.

52. The bushing of claim 32 wherein screen areas nearest an end wall of the bushing have a substantially higher hole area per unit screen area than screen areas closest to a lengthwise centerline of the screen.

53. The bushing of claim 33 wherein screen areas nearest an end wall of the bushing have a substantially higher hole area per unit screen area than screen areas closest to a lengthwise centerline of the screen.

54. The bushing of claim 34 wherein screen areas nearest an end wall of the bushing have a substantially higher hole area per unit screen area than screen areas closest to a lengthwise centerline of the screen.

55. The bushing of claim 35 wherein screen areas nearest an end wall of the bushing have a substantially higher hole area per unit screen area than screen areas closest to a lengthwise centerline of the screen.

56. The bushing of claim 36 wherein screen areas nearest an end wall of the bushing have a substantially higher hole area per unit screen area than screen areas closest to a lengthwise centerline of the screen.
57. The bushing of claim 37 wherein screen areas nearest an end wall of the bushing have a substantially higher hole area per unit screen area than screen areas closest to a lengthwise centerline of the screen.
58. The bushing of claim 38 wherein screen areas nearest an end wall of the bushing have a substantially higher hole area per unit screen area than screen areas closest to a lengthwise centerline of the screen.
59. The bushing of claim 39 wherein screen areas nearest an end wall of the bushing have a substantially higher hole area per unit screen area than screen areas closest to a lengthwise center line of the screen.
60. The bushing of claim 40 wherein screen areas nearest an end wall of the bushing have a substantially higher hole area per unit screen area than screen areas closest to a lengthwise centerline of the screen.
61. A method of making a bushing for fiberizing a molten material, the bushing comprising at least two opposed sidewalls and at least two opposed end walls, a tip plate having a plurality of hollow tips extending from a lower surface, attaching the tip plate to the sidewalls and end walls, the bushing having a boxlike shape having at least four interior corners, welding an interior support structure to a top surface of the tip plate to support the tip plate in operation, the bushing having a screen in the bushing resting on or mounted very near the top of the interior support structure, the interior support structure comprising a plurality of intersecting or crossing internal supports with angles between the intersecting supports at each intersection, the internal support structure, in cooperation with the at least one sidewall and the at least one end wall, forming at least 16 cells located between the bottom of the screen and the top of the tip plate, the screen having a plurality of screen areas containing holes through the screen with a screen area

above each of the cells, adjusting the hole area per unit screen area above each cell to achieve more uniform tip plate temperature profile.

62. The method of claim 61 wherein the interior support structure is made from a precious metal or a precious metal alloy.

63. The method of claim 61 wherein the interior support structure is made to contain diamond shaped cells, and is also attached to the sidewalls by welding.

64. The method of claim 62 wherein the interior support structure is made to contain diamond shaped cells and is attached to the sidewalls by welding.

65. The method of claim 61 wherein supports that are part of the interior support structure are made to enter the interior corners of the bushing.

66. The method of claim 62 wherein supports that are part of the interior support structure are made to enter the interior corners of the bushing.

67. The method of claim 63 wherein supports that are part of the interior support structure are made to enter the interior corners of the bushing.

68. The method of claim 61 wherein the internal support structure is made to contain at least 32 cells between the screen and the tip plate.

69. The method of claim 62 wherein the internal support structure is made to contain at least 32 cells between the screen and the tip plate.

70. The method of claim 63 wherein the internal support structure is made to contain at least 32 cells between the screen and the tip plate.

71. A method of making fibers by introducing a molten material into a bushing for fiberizing a molten material, the bushing comprising at least two opposed sidewalls and

at least two opposed end walls, a tip plate having a plurality of hollow tips extending from a lower surface, the tip plate attached to the sidewalls and end walls, the bushing having a boxlike shape having at least four interior corners, an interior support structure attached to a top surface of the tip plate to support the tip plate in operation, the bushing having a screen in the bushing resting on or mounted very near the top of the interior support structure, the interior support structure comprising a plurality of intersecting or crossing internal supports with angles between the intersecting supports at each intersection, the internal support structure, in cooperation with the at least one sidewall and the at least one end wall, forming at least 16 cells located between the bottom of the screen and the top of the tip plate, the screen having a plurality of screen areas containing holes through the screen with a screen area above each of the cells, adjusting the hole area per unit screen area above each cell to achieve a more uniform tip plate temperature profile and pulling the fibers away from molten glass cones that form below orifices in the tip plate.

72. The method of claim 71 wherein the interior support structure is made from a precious metal or a precious metal alloy.

73. The method of claim 71 wherein the interior support structure contains diamond shaped cells, and is also attached to the sidewalls.

74. The method of claim 72 wherein the interior support structure contains diamond shaped cells and is attached to the sidewalls.

75. The method of claim 71 wherein supports that are part of the interior support structure enter the interior corners of the bushing.

76. The method of claim 72 wherein supports that are part of the interior support structure enter the interior corners of the bushing.

77. The method of claim 73 wherein supports that are part of the interior support structure enter the interior corners of the bushing.

78. The method of claim 71 wherein the internal support structure contains at least 32 cells between the screen and the tip plate.
79. The method of claim 72 wherein the internal support structure contains at least 32 cells between the screen and the tip plate.
80. The method wherein the internal support structure contains at least 32 cells between the screen and of claim 73 the tip plate.